Albert Rothenberg/interview w/JL 8/13/74

AR: I'm very mindful of your time and let me, if I may, switch... This is a word association test. Have you ever had it?

JL: Yes.

AR: Often?

JL: No, as a matter of fact, I can't remember having taken one but I have done some reading about it and I'm still trying to locate a reference on the effects of the milieu on the results of the word association test that I thought was attributed to you and I am unable to find it.

[laughter]

JL: Describe word association.

AR: Young, well in 1906, first used it in order to determine association complexes. That was his notion. Experimentation effects. Did he or did he not find that the person conducting the test would influence the pattern of association.

Oh, he never paid attention to things like that. Later, there has been some good work in that having to do with, I can send you some references. It has to do with the relative atmosphere of anxiety in the subject; what people paid attention to; whether it was taken before or after lunch, and how much eating, imaging... and all of that which is pertinent. But I'll be glad to send you some references.

JL: I think I got something here this morning.

AR: In any event, the test has been used for a million things. [muffled]. high unreliable .... like lie detector test. But I'm interested in it because, at least for me, it shows something like thought patterns. Some say that it would be different _____ but certainly the experimenter influences and that's why I ask you [muffled]

[laughter]

AR. Let's start -- the instruction is simply, I say a word and you give me the first word that comes to mind. AND that's the important thing, that you give me the FIRST word that comes to mind. So here we go.....

AR: Dog

JL: Cat

AR: Father

JL: Mother

AR: Chair

JL: Table

AR: Table

JL: [muffled] [laughter]

AR: Dark

JL: Light

AR: Music

JL: Sound

AR: Sickness

JL: Health

AR: Man

JL: Woman

AR: Petite

JL: Stout

AR: Soft

JL: Hard

AR: Eating

JL: Drinking

AR: Mountain

JL: Hill

AR: House

JL: Barn

AR: Black

JL: White

AR: Mutton

JL: Lamb

AR: Comfort

JL: Discomfort

AR: Hand

JL: Foot

AR: Short

JL: Tall

AR: Fruit

JL: Vegetable

AR: Butterfly

JL: Moth

AR: Sloth

JL: [unclear]

AR: Command

JL: Order

AR: Fair

JL: Pasty

AR: Sweet

JL: Sour

AR: Whistle

JL: Poke

AR: Woman

JL: Man

AR: Cold

JL: Hot

AR: Slow

JL: Fast

AR: Wish

JL: Fulfill

AR: River

JL: Stream

AR: White

JL: Black

AR: Beautiful

JL: Sad

AR: Window

JL: Door

AR: Rough

JL: Smooth

AR: Citizen

JL: Subject

AR: Foot

JL: Hand

AR: Spider

JL: Fly

AR: Needle

JL: Pin

AR: Red

JL: Black

AR: Sleep

JL: Wake

AR: Anger

JL: Sad

AR: Carpet

JL: Rug

AR: Girl

JL: Boy

AR: High

JL: Low

AR: Working

JL: Playing

AR: Sour

JL: Sweet

AR: Earth

JL: Sun

AR: Trouble

JL: Help

AR: Soldier

JL: Infantryman

AR: Cabbage

JL: Vegetable

AR: Hard

JL: Soft

AR: Eagle

JL: Hawk

AR: Stomach

JL: Gastrointestinal tract

AR: Stem

JL: Shoot

AR: Lamp

JL: Fall

AR: Green

JL: [unclear]

AR: Yellow

JL: Blue

AR: Bread

JL: Butter

AR: Justice

JL: Injustice

AR: Boy

JL: Girl

AR: White

JL: Dark

AR: Health

JL: Sickness

AR: Bible

JL: New Testament

AR: Memory

JL: Forget

AR: Sheep

JL: Lamb

AR; Bath

JL: Tub

AR: Cottage

JL: Cheese

AR: Swift

JL: Slow

AR: Blue

JL: Green

AR: Hungry

JL: Sated

AR: Priest

JL: Rabbi

AR: Ocean

JL: Sea

AR: End

JL: Front

AR: Stove

JL: Oven

AR: Long

JL: Short

AR: Religion

JL: Faith

AR: Whiskey

JL: Sour

AR: Child

JL: Boy

AR: Bitter

JL: Sweet

AR: Hammer

JL: Nail

AR: Thirsty

JL: Hungry

AR: City

JL: Country

AR: Square

JL: Round

AR: Butter

JL: Bread

AR: Doctor

JL: Nurse

AR: Loud

JL: Soft

AR: Thief

JL: Policeman

AR: Lion

JL: Tiger

AR; Joy

JL: Sadness

AR: Bed

JL: Board

AR: Heavy

JL: Light

AR: Tobacco

JL; Smoke

AR: Baby

JL: Grownup

AR: Moon

JL: Sun

AR: [unclear]

JL: [unclear]

AR: Quiet

JL: Loud

AR; Green

JL: Blue

AR: Salt

JL: Pepper

AR: Street

JL: Road

AR: King

JL: Queen

AR: Cheese

JL: Butter

AR: Blossom

JL: Flour

AR: Afraid

JL: Fearless

JL: I'll tell you one thing that goes on there, there is a certain dissonance about not being stuck on this point and after awhile there is a certain pattern about getting automatic responses by way of synonyms or antonyms .

AR: Yes, I can see this happening. Between the beginning and the end.

Meaning -- the tendency was to find the strategy. Right?

JL: Yes.

JL: It was uncomfortable of not being able to respond quickly and get rid of it and dispose of the problem. A strategy eventually emerges, which I wasn't thinking of, that's the way my mind is organized, but for any term, one of the quickest set of correlates that could be deduced would be synonyms and antonyms.

I wasn't consciously pursuing it, watching it happen.

[unclear]
[laughter]

AR: Now that's been very helpful. And I will certainly send you off.

JL: What is the reaction time on this type of contact?

AR: Well, in some of the material I will send you, it will explain how that is.

JL: OK.

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[muffled]

AR: Do you have artistic interests yourself?

JL: No.

AR: But, does my information about this in terms of art and science seem to be intimately true from your own experience.

JL: Well, I can see a number of places where there might be a good deal of overlap. If I think of non representationist picture making, there is obviously a willingness to relax some of the constraints that are involved in one-to-one mapping of what there is out there, what you would want to put on the frame and try to find some other variants that remain. To think of what goes into hypothesis formation -- particularly if it is of a more aggressive kind.

I don't go along with the sharp distinctions that Tom Kuhn makes between normal science and revolutionary but there is

certainly a gradation of activity where problems are presented and whether fairly predictable procedures for solving them and even thinking of the problem doesn't have sure footing in terms of what the normal steps would be. Certainly the imagination of Peter to protecting the problem or surprising approaches to solutions can be totally different including some are black of some of the images involved and formulated such notions in the respective literature and some of us are acquainted with the artistic procedure in the creative literature.

AR: Well in separating the discovery from verification, do you see that discovery has anything akin to inspiration.

JL: What do you say that we haven't already said when you quoted the term 'inspiration'.

AR: Most common terms, it is usually accepted as a very dramatic kind of experience. I'm glad you questioned me on this because I tend and have in fact sort to invalidate the fact that it's dramatic as most people -- the common picture of the poet being struck by some bolt from the blue and then running out..... . That kind of thing. I'm not saying that my experience has been that that's not the way things work, but, I meant that kind of description.

JL: Well, I understand what you mean by the phrase now.

That's a characterization of certain events or _____ of discovery which I think sometimes applies. I have sometimes gotten up in the morning recognizing the existence of a problem and didn't have one when I went to bed. It seems like a fairly sudden event and I would write it down to make sure that I'd capture it while it was still fresh so it wouldn't _____ the edges and so on. So inspirations yes, do occur.

AR: That's a distinction though. To wake up recognizing the existance of a problem. It's not the same as what occurs, as I understand it. One could talk about it as an existance of a problem, as I suppose, in psychological terms but the artist usually, when he talks about inspiration , talks about solving something. And I understand what you mean when you say .....

JL: There are somewhat similar kinds of events. A solution is finding where things do fit and discovering a problem is finding in fact that they don't but there is some element

of correspondence of understanding the elements of the structures that you are relating for and that they have in common. Yes, I would say that there are inspirations of that kind.

The most frequent is the illumination of how stupid I've been. That I waste a lot of time pursuing some path and that there is now good theoretical reason to understand why it was inappropriate to _____ miss some important datum that was not obviously related spirit that was to be brought into recognition and so on. And I wasn't being _____ in suggesting that 90% of the time they have a negative result of allowing /closing off some branch of inquiry or wasting one's time. Only more rarely, they have a more positive function of opening something up.

AR: Yet, it seems to me more contrary that one would wake up with the notion that there is a problem because somehow it's a disjunctive recognition -- at least, in so far as so-called inspiration is described. It's meant to be accompanied by relief and pleasure and gratification. Now the discovery of a problem I would assume means cognitively there is now discomfort. I would use the word dissonance. There is something recognized as why would that be experienced as a bolt in the morning or something as such as that.

JL: There is a certain synthesis involved. Let me explain about discovering the problem. There are more data that are not clearly and obviously related to clear-cut theoretical structure that are. The discovery of a problem may be the construction of a new kind of question which embraces within it a large number of loose ends. If it's an interesting problem it will tend to do that and there is the equality of now being the deal of the largest scale construct with a lot of scattered details. You haven't solved anything in that you don't have a conclusive answer whether or not a and b and c and d are true is that they are somewhat _____ is out of the question. Again, it gives you a fair way to manage the universe if you can develop such abstracts. I've had many more experiences discovering questions than solutions. I'm not an engineer or applied scientist but am simply confronted with issues in which some ingenuity may be required or by a set of procedures that need to be solved. Like the computer programming -- one or another every day -- and they are solvable problems. But it has to be a pretty sticky bug to get the sense of illumination [inaudible].

AR: May I ask you for an example of timely discovered problems of illumination.

JL: Well, a couple of days ago, we were having a lab meeting which had some puzzling findings and all the emphasis had been on -- well I could go through some very detailed steps -- the experimental procedure involved the activation of certain enzyme on DNA from a given bug and then that bacterium gives up a certain DNA and goes through certain genetic changes. And some rather peculiar things have been happening in the bacteria that have been altered through this experience and we were inventing all kinds of hypotheses about what could be going on around the cell. It then occurred to me that we were making without questioning certain assumptions about the behavior of the enzyme and that if the enzyme were reversible which was not mentioned in any of the previous work as I know that had been studied that the enzyme not only broke DNA but could also rejoin DNA pieces by an exact reversal of it's original mechanism. It might help to unify most of the other observations. This now simplified our research strategy to transform what the issue was at the time being and so said let's go and find out how the enzyme behaves. So it was discovering a problem. And so, until that point, none of us had realized how the issue of the reversibility of the enzyme had been unexamined. So in that sense we discovered the problem. And could have extensibly far implications of what I just said.

AR: But the notion of reverse mutation.

JL: No, this is reverse on the action of the enzyme.

AR: I understand that. The notion of reverse mutation was an issue you proposed.

JL: Yes.

AR: Was that by any chance, came as a sign of illumination Do you recall that?

JL: Oh yes, I guess my scientific career sort of starts from just an event and the realization of the question of sexuality in bacteria was an unexamined issue -- it's hard to find the date on which the common myth of asexual bacteria is based . There certainly were not any and none to any degree concordant with the level of inquiry that was possible. It's a very similar discovery of a problem. It took a few months to work out as an answer. And by far the most interesting step in that

procedure was it's recognition of the problem.

AR: And it came as a discreet moment. That's what I describe...

JL: Well, I've been attending to a great deal to where it might have come from and I really cannot document it -- it's just too long ago. I was working very closely with Francis Ryan at that time who would have been an important stimulant with whom I had many important discussions but I have a few scribbles which are not clearly dated. I would have some difficulty reading it. It wasn't that unique. Once when you went to look for it, one could find similar anticipations or expressions from the people but not in a way that hold together the statement of the problem and essentially about it's priority and all sorts of methods for trying to attack it and anticipating what kinds of questions there might be about those methods and being able to bolster them. It all worked out in advance what one would do and what level of reliability would be achieved by a given set of procedures and working your way to a path that makes sense in which all the contingencies have been thought about and dealt with so you make efficient choices as to procedures and so forth. That all went very quickly once the original notion was set up.

Now it was in the context of work already going on -- on reverse mutation, especially in the distinctiveness of Avery's finding that the compound that could cause changes in bacteria was DNA. A enormous amount of speculation that that aroused . It is evident that DNA is genetic material or not -- well things that happen in bacteria have limited validity to genetics because did bacteria have genes. Isn't it too bad that bacteria is asexual. They can't be crossed or invalidate with any genes or not. The question on how to get further on with this rather dramatic discovery of Avery's was either to show that bacteria could be crossed and in which case, within the framework of bacterial genetics the DNA observations would have their own validity or trying to use DNA organisms as genetics was very well standardized. My very first experience _____ of the latter branch of this exploratory procedure and in the course of which ran into reverse mutation {inaudible} it really prevented the exhausted application of test for DNA induced genetic change that could happen spontaneously in a somewhat unexpected fashion. So then shifting to the other foot, {inaudible} see what you can do about genetics and bacteria and bolstered by the tools that were developed {noise on tape}

AR: _____ regarding the technique that you used, was that a more

organized less illuminating experience along the way?

JL: Well, one could use precisely the methodology that developed in neurospora. That would be the ideal way to answer the question. I would not know how now to write a program now that could make that inductively .

AR: I was wondering what you said when you said you were separating verification from discovery. But you don't go as far as Tom Kuhn does. The process of verification -- what kind is it?

JL: One first adduces a test. There's no automatic way of generating the most efficient test and hypothesis. So that in itself is an act of discovery. In many, many cases not always you find unique approaches to solving problems and the same creative aura as discovering the questions. The whole spectrum of it -- and then you apply the test. Once it's applied it's very much like finding the proof of a algorithm. You know, once it's there, it's a rigorous, logical, deductive demonstration. Discovering the proof is not a story. That is something that is much closer in texture to the kinds of things we do on computer these days and certainly very limited domain has the {inaudible}. Whitehead and Russell, _____ calculus. and discover all those proofs with computer programs now these days. In fact, you don't have to bother to because of _____ different procedure verification which makes the whole thing obsolete. So there is a fact independently of the explicit proofs that Whitehead and Russell offer {inaudible}. There is in fact a mechanical procedure for determining the correctness of the theorem. It invovles simple combinatorial _____. It is just as well it wasn't discovered sooner because there is something very beautiful about the proofs Whitehead and Russell did discover.

AR: How about the form in which the reports actually occur. Let's say about the reverse enzyme process.

JL: I have thought about that in connection to your programs. One of our limitations is that we have very closing ways of doing all this. We don't have the richness of analog representation readily available to us of that picture building you give us. We try to do more in that direction. We have not done it.

AR: Is it possible you remember the exact visualization?

JL: Of the enzyme?

AR: Yes.

JL: This is a well tooled procedure so that it is actually so conscious. Imagine yourself as an atom in the molecule that you are thinking about and trying to visualize all the environmental circumstances that would be impinging on you and what could happen to you if you were living there. That'a notion that is not too uncommon. It's contrived by now, having bumped into that kind of thing a number of times. It's quite systematic by now. It's a way of constructing different forms of hypotheses, trying to imagine what are sensible and not sensible variables to keep track of -- what could an atom in that molecule know about the outside world is a way of sorting out whatever inputs there are.

AR: When you say you bumped into it a number of times -- in your own experience or others.

JL: No, no. {inaudible}

AR: You're telling of successful..... . What about other sensory modality?

JL: In this realm, not many. Some of it is image free. I don't have a mind of visual representation of logical propositions and so on. There is a logic machine that goes through syllogisms without the benefit of such. To some extent the calculation falls into that category although it often ends up as being more visual. When it comes to retrieval as against process than acoustic factors are the main impediment attended to more by a pre-eminent role and how often do you recall that his last name begins with an 'r' and you hear the meter of it but you cannot fill in all the parts. I think I'm projecting on you my own experience but I think that is pretty common. I would assume of course that there are acoustic codes connected with memory retrieval and not to any great sense visual ones -- at least in my own introspection I would see what's important there. But that is sort of disjointed of what we were talking about before.

AR: Just this question -- I had no idea of general distinction there is.

JL: Well, I think there is some visual imagery to it in searching but very little acoustic when it comes to statements of proposition.

AR: Are you interested in music?

JL: Oh, in an amateurish way. I enjoy a concert now and then. I had one course in music appreciation in college and that's the extent of my music education.

AR: Languages?

JL: Not very proficiently. When I was much younger I was pretty much very skillful but I've not kept up any drill. I can become very fluent very quickly in Spanish or Italian, Hebrew, German or French while I'm in the country for a few days. People seem to be very suprised on much I can capture. I'm surprised myself.

AR: To go back again. You imagined yourself in the enzyme and all the things that would impinge on the enzyme and that at a sudden moment you realize through various processes that life begins and ends.... . But that's an abstract -- not a visual thought.

JL: There's a process if this is the only thing that can happen or that can it come back together again. There's an abstract thought that transition state when the enzyme doesn't know whether it's making or breaking a bond and just thinking about the point of breaking [inaudible].....

Now that's not an earth shaking thing and it's probably wrong but I thought I would give you a 'for instance'.

AR: Now how often does that happen -- do you have much distinction between those thoughts you had and occur with almost perfect certainty that they are right and then they work out to be right or ... .

JL: No, I have never had that certainty.

AR: Because some people think of that, characteristics of tremendous certainty that they may have gotten it right or I wonder if there is more of an issue of theoretical or mathematical thinking.

JL: I might be ready to apply a rough and ready verification. I could do that in my head.

I raise this question. My first response was with my students. [inaudible]

No, I'm too much wetted to experimental level of verification.

AR: Or any kind of emotional certainty that is a verification.

JL: Between myself being trained not to meet too quickly, have a good deal of skepticism, especially self skepticism and I think that's very important if you want to write very often and because too hasty an attachment might be prejudicial.

AR: Along with your research, have you been involved in a great deal of administration at some time?

JL: Yes, in different ways.

AR: Is that also creative? Might you say?

JL: Yes, I wish I could make it more so. I could do it better if I got more enthusiastically invovled in that fashion -- but sure. There's a lot of problem solving, generalizations, a sense of seeing what the real problem is and it's just not a piece of paper that comes across your desk. It's also creative in a different sense of the creative force it gives to other people and all of the interpersonal issues that are connected with doing that.

AR: In terms of that latter factor do you feel you evolve some pattern of judgment about recognizing creativity in others? I don't have any specifics in mind, but in a general way.

JL: I have not given that very much thought. It's connected with the question of scientific productivity and in that particular context you probably get reasonably consensual judgments by inclusive people of how creative their works seem to be. One has common sense approahes to the degree of imagination and criticism and caution combined that people show in just ordinary conversation. {inaudible} that's the thing I kind of look for and the problem solving style is another way of posing it. I will attempt to test them in order of their day to day issues -- how they solve the problem of communicating to me of expressing themselves of putting themselves in the best light of how they approach their career issues; how carefully they follow through, why they want to come here and so on. That's not just creativity.

AR: One of the problems I have in transferring from creativity to

science -- such as a typical problem to understand how the end result is announced. In other words, is a product made and the scientific product is a discovery and whether one should say is it only the earth shaking discovery or the term was if the person was creative or is it the process to which that has been attained which can be repeated over and over again and sometimes will not lead to such great products.

JL: How do you judge that?

AR: Well, you judge the artist by his product. That's true. But is it true that something is made of science in the same sense -- that something new occurs since at least presumably the structure in their nature is to be found but made by the scientist himself. Therefore it is not his product.

JL: Well, that's a positive view of it. The fact is that only a small part of nature has been exposed. The elements that have been attacked are very much the product of a particular creativity that scientists have applied to it. It's not that different from the sculptor who exposes the figure in the marble all along. You just have to chip away the excess. So I say 'yes' there certainly is a product at a certain level of discovery would occur by strictly mechanical procedures. But not very much.

Almost by definition anything which is recognized as an innovation as extending to serve human knowledge had to have a creative element -- may be pretty small potatoes -- but had to be a recognition, wouldn't it? Something not previously known that was interesting that was worth presenting to one's colleagues as much as one other person _____ would have to have one such element.

AR: I hope to answer in that direction but that's what I hope to be the orientation. What I have done is focus however on the process of creation. I have been interested in what happens from the initial formulation -- it sounds to me to be particularly fortuitous to say that now the initial formulation doesn't have the same sense as finding the problem. The initial formulation of a work of art is not analagous to your description of finding a problem. However, after that there may be steps -- perhaps similarities.

Again, I have the easier job of visualizing the task that confronts the painter -- the easel, the canvass, some paints. What is he going to do next? There's some conception that

bears some element of novelty which will be expressive to himself or say something that will be an abstraction about some aspect of the world. He cannot put all of the world on one piece of canvas and so on. So, he's discovering something which seems to be analagous to some problem he's doing anything interesting. Now if it's less interesting, it's still in the same process of doing it. He's applying a certain set of transformations to what he sees as obviously making choices of what to put in, of what not to put in, what emphases to make and so on. I think the distinction is one of validation and the scientist does operate in the framework of a positive view of the world. It really is out there and there is a test of public knowledge about his final judgment about his conclusions which is a little different from the audience the painter perceives. His judgment you may or may not respect as being applicable to some concerns he is not quite directed towards persuasion of his colleagues as the scientist usually is. But I don't think the painter can operate in affinity of worlds. Some of them have a different validity than others and I suspect.....

AR: Oh yes. I was really meaning the kind of affectual experience. Now I know how to attack. I may be wrong on jumping on that because I mean that may come a little bit later. You know, the notion -- that I'll start something and sees what happens is what happens more in art. It is much more experimental at that phase and then at some point it becomes coherent. I mean artists speak at some point at what they are trying to say.

JL: Yes. I think the differences are what you are choosing to start from and science in the lab. There may be a difference. A scientist never finishes one project and starts another one. There is continuous overlap between the two. That's probably true of artists as well.

AR: Even if they're making a different painting. They can' have forgotten what they were doing yesterday.

JL: There are different levels of commitment to a program in doing scientific work and there probably is more transferability during the course of work on a previous program I may already laying the ground work and being stimulated by a whole variety of other projects and that may or may not be true in {inaudible}.